Claims

[c1] A braking system for use within a hybrid electric vehicle of the type having a driveline which selectively and rotatably drives a pair of wheels, said braking system comprising:
an engine which is adapted to selectively provide a first torque to said driveline;
a first clutch which is adapted to selectively disconnect said engine from said driveline;
a transaxle assembly which is adapted to selectively provide a negative torque to said driveline effective to recover energy during certain braking events; and
a control system which controls said first clutch and which selectively disengages said first clutch during said certain braking events, effective to disconnect said engine from said driveline during said certain braking events, thereby increasing said recovered energy.

[c2] The braking system of claim 1 wherein said vehicle further includes an accelerator pedal, and wherein said control system is further effective to selectively disengage said first clutch during based upon a position of said accelerator pedal and to cause said transaxle assembly to provide a simulated compression braking force to said driveline based upon said position of said accelerator pedal, effective to simulate engine drag and to recover energy.

[c3] The braking system of claim 1 further comprising:
a hydraulic braking system which selectively provides a friction braking force to said vehicle; and
wherein said control system is further effective to control said regenerative torque and said friction braking force based upon at least one vehicle attribute.

[c4] The braking system of claim 3 wherein said transaxle assembly comprises a motor/generator, and wherein said at least one vehicle attribute comprises a speed of said motor/generator.

[c5] The braking system of claim 4 wherein said control system is effective to reduce said regenerative braking force as said speed of said vehicle decreases below a predetermined value.

[c6] The braking system of claim 5 wherein said regenerative braking force is reduced linearly as said speed of said vehicle decreases below said predetermined value.

[c7] The braking system of claim 3 wherein said at least one vehicle attribute comprises a master cylinder pressure.

[c8] The braking system of claim 3 wherein said at least one vehicle attribute further comprises a state-of-charge of said battery.

[c9] A hybrid electric vehicle comprising:
a pair of wheels;
a driveline which selectively and rotatably drives said pair of wheels;
an engine which is selectively and operatively coupled to and which selectively provides a first torque to said driveline;
a first clutch which selectively connects and disconnects said engine from said driveline;
a motor/generator which selectively provides an amount of negative torque to said driveline effective to recover energy during certain braking events;
at least one sensor which measures at least one vehicle attribute; and
a control system which is communicatively coupled to said at least one sensor to said first clutch and to said motor/generator, and which is effective to selectively disengage said first clutch during said certain braking events, thereby disconnecting said engine from said driveline during said certain braking events, and to control said amount of negative torque based upon said at least one vehicle attribute.

[c10] The hybrid electric vehicle of claim 9 wherein said at least one sensor comprises a pressure sensor, and wherein said at least one vehicle attribute comprises a master cylinder pressure.

[c11] The hybrid electric vehicle of claim 10 wherein said at least one sensor comprises an accelerator pedal position sensor, and wherein said at least one vehicle attribute comprises an accelerator pedal position.

[c12] The hybrid electric vehicle of claim 11 wherein said control system is further

effective to selectively disengage said first clutch during based upon said accelerator pedal position and to cause said motor/generator assembly to provide a simulated compression braking force to said driveline based upon said accelerator pedal position, effective to simulate engine drag and to recover energy.

[c13] The hybrid electric vehicle of claim 10 further comprising:
at least one battery which selectively receives said recovered energy from said motor/generator; and
wherein said controls system is further effective to control said amount of negative torque based upon said a state-of-charge of said at least one battery.

[c14] A method of providing regenerative braking within a vehicle including an engine and a transaxle assembly which are selectively connected to a driveline, said method comprising the steps of:
sensing a braking event;
causing said transaxle to provide a regenerative braking torque to said driveline, effective to generate an amount of energy; and
selectively disconnecting said engine from said driveline during said braking event, effective to increase the amount of energy generated during said braking event.

[c15] The method of claim 14 further comprising the steps of:
sensing an accelerator position; and
selectively causing said transaxle assembly to provide a regenerative braking torque based upon said accelerator position when said vehicle is operating in a motor only mode, said regenerative braking torque having a value effective to simulate an engine compression braking force.

[c16] The method of claim 15 further comprising the steps of:
selectively disconnecting said engine from said driveline based upon said accelerator position when said vehicle is operating in a hybrid drive mode, and causing said transaxle assembly to provide a regenerative braking torque having a value effective to simulate an engine compression braking force.

[c17] The method of claim 16 wherein said vehicle further includes a battery, said method further comprising the steps of:
determining a state-of-charge of said battery; and
performing compression braking with said engine when said state-of-charge of said battery is full.

[c18] The method of claim 14 further comprising the steps of:
sensing a master cylinder pressure; and
controlling said regenerative braking torque based upon said master cylinder pressure.

[c19] The method of claim 18 wherein said regenerative braking torque is reduced as said master cylinder pressure increases, after said master cylinder pressure exceeds a predetermined value.